SEQUENCE LISTING

<110> Pharmacia & Upjohn

<120> CRYSTALLIZATION AND STRUCTURE DETERMINATION OF STAPHYLOCOCCUS AUREUS UDP-N-ACETYLENOLPYRUVYLGLUCOSAMINE REDUCTASE (S. aureus MurB)

<130> 6241.NCP

<140> Unassigned
<141> 2000-08-04

<150> 60/147,164
<151> 1999-08-04

<160> 11

<170> PatentIn Ver. 2.1

<210> 1
<211> 326
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Recombinant S. aureus MurB protein including polyhistidine region

<400> 1

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Met Arg Gly Ser His His His His His His Thr Asp Pro Ile Asn Lys
 1               5                  10                  15

Asp Ile Tyr Gln Ala Leu Gln Gln Leu Ile Pro Asn Glu Lys Ile Lys
            20                  25                  30

Val Asp Glu Pro Leu Lys Arg Tyr Thr Tyr Thr Lys Thr Gly Gly Asn
        35                  40                  45

Ala Asp Phe Tyr Ile Thr Pro Thr Lys Asn Glu Glu Val Gln Ala Val
    50                  55                  60

Val Lys Tyr Ala Tyr Gln Asn Glu Ile Pro Val Thr Tyr Leu Gly Asn
65                  70                  75                  80

Gly Ser Asn Ile Ile Ile Arg Glu Gly Gly Ile Arg Gly Ile Val Ile
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                85                  90                  95

Ser Leu Leu Ser Leu Asp His Ile Glu Val Ser Asp Asp Ala Ile Ile
            100                 105                 110

Ala Gly Ser Gly Ala Ala Ile Ile Asp Val Ser Arg Val Ala Arg Asp
        115                 120                 125

Tyr Ala Leu Thr Gly Leu Glu Phe Ala Cys Gly Ile Pro Gly Ser Ile
    130                 135                 140

Gly Gly Ala Val Tyr Met Asn Ala Gly Ala Tyr Gly Gly Glu Val Lys
145                 150                 155                 160

Asp Cys Ile Asp Tyr Ala Leu Cys Val Asn Glu Gln Gly Ser Leu Ile
                165                 170                 175

Lys Leu Thr Thr Lys Glu Leu Glu Leu Asp Tyr Arg Asn Ser Ile Ile
            180                 185                 190

Gln Lys Glu His Leu Val Val Leu Glu Ala Ala Phe Thr Leu Ala Pro
        195                 200                 205

Gly Lys Met Thr Glu Ile Gln Ala Lys Met Asp Asp Leu Thr Glu Arg
    210                 215                 220

Arg Glu Ser Lys Gln Pro Leu Glu Tyr Pro Ser Cys Gly Ser Val Phe
225                 230                 235                 240

Gln Arg Pro Pro Gly His Phe Ala Gly Lys Leu Ile Gln Asp Ser Asn
                245                 250                 255

Leu Gln Gly His Arg Ile Gly Gly Val Glu Val Ser Thr Lys His Ala
            260                 265                 270

Gly Phe Met Val Asn Val Asp Asn Gly Thr Ala Thr Asp Tyr Glu Asn
        275                 280                 285

Leu Ile His Tyr Val Gln Lys Thr Val Lys Glu Lys Phe Gly Ile Glu
    290                 295                 300

Leu Asn Arg Glu Val Arg Ile Ile Gly Glu His Pro Lys Glu Ser Leu
305                 310                 315                 320

Gln Pro Ser Leu Ile Ser
                325
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<210> 2
<211> 342
<212> PRT
<213> Escherichia coli

<400> 2

Met Asp His Ser Leu Lys Pro Trp Asn Thr Phe Gly Ile Asp His Asn
1 5 10 15

Ala Gln His Ile Val Cys Ala Glu Asp Glu Gln Gln Leu Leu Asn Ala
20 25 30

Trp Gln Tyr Ala Thr Ala Glu Gly Gln Pro Val Leu Ile Leu Gly Glu
35 40 45

Gly Ser Asn Val Leu Phe Leu Glu Asp Tyr Arg Gly Thr Val Ile Ile
50 55 60

Asn Arg Ile Lys Gly Ile Glu Ile His Asp Glu Pro Asp Ala Trp Tyr
65 70 75 80

Leu His Val Gly Ala Gly Glu Asn Trp His Arg Leu Val Lys Tyr Thr
85 90 95

Leu Gln Glu Gly Met Pro Gly Leu Glu Asn Leu Ala Leu Ile Pro Gly
100 105 110

Cys Val Gly Ser Ser Pro Ile Gln Asn Ile Gly Ala Tyr Gly Val Glu
115 120 125

Leu Gln Arg Val Cys Ala Tyr Val Asp Ser Val Glu Leu Ala Thr Gly
130 135 140

Lys Gln Val Arg Leu Thr Ala Lys Glu Cys Arg Phe Gly Tyr Arg Asp
145 150 155 160

Ser Ile Phe Lys His Glu Tyr Gln Asp Arg Phe Ala Ile Val Ala Val
165 170 175

Gly Leu Arg Leu Pro Lys Glu Trp Gln Pro Val Leu Thr Tyr Gly Asp
180 185 190

Leu Thr Arg Leu Asp Pro Thr Thr Val Thr Pro Gln Gln Val Phe Asn
195 200 205

Ala Val Cys His Met Arg Thr Thr Lys Leu Pro Asp Pro Lys Val Asn
210 215 220

Gly Asn Ala Gly Ser Phe Phe Lys Asn Pro Val Val Ser Ala Glu Thr
225 230 235 240

Ala Lys Ala Leu Leu Ser Gln Phe Pro Thr Ala Pro Asn Tyr Pro Gln
245 250 255

Ala Asp Gly Ser Val Lys Leu Ala Ala Gly Trp Leu Ile Asp Gln Cys
260 265 270

Gln Leu Lys Gly Met Gln Ile Gly Gly Ala Ala Val His Arg Gln Gln
275 280 285

Ala Leu Val Leu Ile Asn Glu Asp Asn Ala Lys Ser Glu Asp Val Val
290 295 300

Gln Leu Ala His His Val Arg Gln Lys Val Gly Glu Lys Phe Asn Val
305 310 315 320

Trp Leu Glu Pro Glu Val Arg Phe Ile Gly Ala Ser Gly Glu Val Ser
325 330 335

Ala Val Glu Thr Ile Ser
340

<210> 3
<211> 259
<212> PRT
<213> Helicobacter pylori

<400> 3
Met Leu Glu Thr Thr Ile Asp Phe Ser Arg Tyr Ser Ser Val Lys Ile
1 5 10 15

Gly Thr Pro Leu Lys Val Ser Val Leu Glu Asn Asp Asp Glu Ile Ser
20 25 30

Gln Glu His Gln Ile Ile Gly Leu Ala Asn Asn Leu Leu Ile Ala Pro
35 40 45

Ser Ala Lys Asn Leu Ala Leu Leu Gly Lys Asn Tyr Asp Tyr Ile Cys
50 55 60

Asp Lys Gly Glu Cys Val Glu Ile Gly Gly Ala Ala Asn Ala Ser Lys
65 70 75 80

Ile Phe Asn Tyr Phe Arg Ala Asn Asp Leu Glu Gly Leu Glu Phe Leu
85 90 95

Gly Gln Leu Pro Gly Thr Leu Gly Ala Leu Val Lys Met Asn Ala Gly
100 105 110

Met Lys Glu Phe Glu Ile Lys Asn Val Leu Glu Ser Ala Cys Ile Asn
115 120 125

Asn Gln Trp Leu Glu Lys Glu Ala Leu Gly Leu Gly Tyr Arg Ser Ser
130 135 140

Gly Phe Ser Gly Val Val Leu Arg Ala Arg Phe Lys Lys Thr His Gly
145 150 155 160

Phe Arg Glu Gly Val Leu Lys Ala Cys Gln Ser Met Arg Lys Ser His
165 170 175

Pro Lys Leu Pro Asn Phe Gly Ser Cys Phe Lys Asn Pro Pro Asn Asp
180 185 190

His Ala Gly Arg Leu Leu Glu Gly Val Gly Leu Arg Gly Tyr Cys Leu
195 200 205

Lys Arg Val Gly Phe Ala Lys Glu His Ala Asn Phe Leu Val Asn Leu
210 215 220

Gly Gly Ala Glu Phe Glu Glu Ala Leu Asp Leu Ile Glu Leu Ala Lys
225 230 235 240

Ala Arg Val Leu Gln Glu Tyr Gly Ile His Leu Glu Glu Glu Val Lys
245 250 255

Ile Leu Arg

<210> 4
<211> 297
<212> PRT
<213> Aquifex aeolicus

<400> 4
Met Leu Phe Leu Lys Asn Val Pro Leu Gln Asn Leu Thr Thr Ile Lys
1 5 10 15

Ile Gly Gly Arg Val Ser Phe Tyr Ala Glu Pro Ser Asp Leu Lys Glu
20 25 30

Ile Ser Leu Cys Ile Asp Phe Ser Lys Ser Arg Asp Ile Pro Leu Phe

```
          35                  40                  45

Val Leu Gly Asn Gly Ser Asn Thr Ile Phe Gly Asp Val Arg Gly Leu
     50                  55                  60

Val Val Asn Leu Lys Asn Leu Lys Gly Phe Lys Val Lys Glu Ile Lys
 65                  70                  75                  80

Gly Lys Phe Phe Val Glu Ala Phe Ser Gly Thr Pro Leu Lys Asp Leu
                 85                  90                  95

Ile Arg Phe Ser Val Lys Glu Asn Val Lys Ser Phe Tyr Lys Leu Leu
            100                 105                 110

Gly Phe Pro Ala Ser Val Gly Gly Ala Val Ser Met Asn Ala Gly Ala
        115                 120                 125

Phe Gly Val Glu Ile Ser Asp Phe Leu Lys Glu Val Tyr Phe Val Asp
    130                 135                 140

Trp Glu Gly Lys Leu Gln Lys Ala Lys Arg Asp Glu Leu Asn Phe Ser
145                 150                 155                 160

Tyr Arg Lys Ser Pro Phe Pro Lys Leu Gly Ile Val Phe Lys Val Val
                165                 170                 175

Phe Glu Phe Glu Arg Ser Lys Glu Asn Ile Leu Pro Lys Tyr Glu Lys
            180                 185                 190

Ile Arg Arg Ile Arg Lys Glu Lys Gln Pro Ile Asn Leu Pro Thr Ser
        195                 200                 205

Gly Ser Thr Phe Lys Asn Pro Glu Gly Asn Phe Ala Gly Lys Leu Leu
    210                 215                 220

Glu Lys Ala Gly Leu Lys Gly Phe Arg Leu Lys Asn Val Gly Phe Ser
225                 230                 235                 240

Glu Lys His Ala Asn Phe Leu Val Asn Tyr Gly Gly Gly Thr Phe Ser
                245                 250                 255

Glu Val Val Asp Leu Ile Asn Ile Ala Lys Glu Arg Val Tyr Glu Asn
            260                 265                 270

Phe Gly Ile Val Leu Glu Glu Glu Val Lys Leu Ile Glu Ser Ser Gly
        275                 280                 285

Ser Asp Gly Trp Lys Val Leu Gly Ala
```

290 295

<210> 5
<211> 303
<212> PRT
<213> Bacillus subtilis

<400> 5

Met Glu Lys Val Ile Gln Glu Leu Lys Glu Arg Glu Val Gly Lys Val
1 5 10 15

Leu Ala Asn Glu Pro Leu Ala Asn His Thr Thr Met Lys Ile Gly Gly
20 25 30

Pro Ala Asp Val Leu Val Ile Pro Ser Ser Val Asp Ala Val Lys Asp
35 40 45

Ile Met Asp Val Ile Lys Lys Tyr Asp Val Lys Trp Thr Val Ile Gly
50 55 60

Arg Gly Ser Asn Leu Leu Val Leu Asp Glu Gly Ile Arg Gly Val Val
65 70 75 80

Ile Lys Leu Gly Ala Gly Leu Asp His Leu Glu Leu Glu Gly Glu Gln
85 90 95

Val Thr Val Gly Gly Gly Tyr Ser Val Val Arg Leu Ala Thr Ser Leu
100 105 110

Ser Lys Lys Gly Leu Ser Gly Leu Glu Phe Ala Ala Gly Ile Pro Gly
115 120 125

Ser Val Gly Gly Ala Val Tyr Met Asn Ala Gly Ala His Gly Ser Asp
130 135 140

Met Ser Glu Ile Leu Val Lys Ala His Ile Leu Phe Glu Asp Gly Thr
145 150 155 160

Ile Glu Trp Leu Thr Asn Glu Gln Met Asp Phe Ser Tyr Arg Thr Ser
165 170 175

Val Leu Gln Lys Lys Arg Pro Gly Val Cys Leu Glu Ala Val Leu Gln
180 185 190

Leu Glu Gln Lys Asp Lys Glu Ser Ile Val Gln Gln Met Gln Ser Asn
195 200 205

```
Lys Asp Tyr Arg Lys Asn Thr Gln Pro Tyr Ser Ser Pro Cys Ala Gly
    210                 215                 220

Ser Ile Phe Arg Asn Pro Leu Pro Asn His Ala Gly Asn Leu Val Glu
225                 230                 235                 240

Lys Ala Gly Leu Lys Gly Tyr Gln Ile Gly Gly Ala Lys Ile Ser Glu
                245                 250                 255

Met His Gly Asn Phe Ile Val Asn Ala Gly Gly Ala Ser Ala Lys Asp
            260                 265                 270

Val Leu Asp Leu Ile Asp His Val Lys Lys Thr Ile Arg Glu Lys Tyr
        275                 280                 285

Glu Ile Asp Met His Thr Glu Val Glu Ile Ile Gly Gly Asn Arg
    290                 295                 300
```

<210> 6
<211> 302
<212> PRT
<213> Borrelia burgdorferi

<400> 6

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Met Pro Lys Ser Leu Asn Asn Phe Leu Lys Lys Ile Asn Ile Lys Pro
  1               5                  10                  15

Gln Thr Lys Asn Leu Ala Asn Tyr Thr Thr Tyr Lys Ile Gly Asn Ile
             20                  25                  30

Ser Lys Leu Phe Leu Thr Pro Lys Asn Ile Lys Glu Ala Glu Asn Ile
         35                  40                  45

Phe Lys Ala Ala Ile Glu Glu Lys Ile Lys Leu Phe Ile Leu Gly Gly
     50                  55                  60

Gly Ser Asn Ile Leu Val Asn Asp Glu Arg Glu Ile Asp Phe Pro Ile
 65                  70                  75                  80

Ile Tyr Thr Gly Tyr Leu Asn Lys Ile Glu Ile His Glu Asn Lys Ile
                 85                  90                  95

Val Gly Glu Cys Gly Ala Asp Phe Glu Ser Leu Cys Lys Ile Ala Leu
            100                 105                 110

Asp Asn Ser Leu Ser Gly Leu Glu Phe Ile Tyr Gly Leu Pro Gly Thr
        115                 120                 125
```

Leu Gly Gly Ala Val Trp Met Asn Ala Arg Cys Phe Gly Asn Glu Ile
130 135 140

Ser Glu Ile Leu Lys Lys Ile Thr Phe Ile Asp Asp Lys Gly Lys Thr
145 150 155 160

Ile Cys Lys Glu Phe Lys Lys Glu Asp Phe Lys Tyr Lys Ile Ser Pro
165 170 175

Phe Gln Asn Lys Asn Phe Phe Ile Leu Lys Ile Glu Leu Asn Leu Lys
180 185 190

Lys Asp Asn Lys Lys Ile Ile Glu Glu Lys Met Asn Lys Asn Lys Gln
195 200 205

Ala Arg Ile Asn Arg Gly His Tyr Leu Phe Pro Ser Gly Gly Ser Thr
210 215 220

Phe Lys Asn Asn Lys Ala Phe Leu Lys Pro Ser Gly Gln Ile Ile Glu
225 230 235 240

Glu Cys Lys Leu Lys Gly Leu Ser Ile Gly Gly Ala Thr Val Ser Lys
245 250 255

Tyr His Gly Asn Phe Ile Ile Asn Ile Asn Asn Ala Thr Ser Lys Asp
260 265 270

Ile Lys Ser Leu Ile Glu Lys Val Lys Ala Glu Val Tyr Leu Lys Thr
275 280 285

Gly Leu Leu Leu Glu Glu Glu Val Leu Tyr Ile Gly Phe Lys
290 295 300

<210> 7
<211> 304
<212> PRT
<213> Chlamydia pneumoniae

<400> 7
Met Lys Glu Ala Ala Pro Met His Phe Pro Phe Pro Val Arg Arg Ser
1 5 10 15

Val Trp Leu Asn Arg Tyr Ser Thr Phe Arg Ile Gly Gly Pro Ala Asn
20 25 30

Tyr Phe Lys Ala Ile His Thr Ile Glu Glu Ala Arg Glu Val Ile Arg

35 40 45

Phe Leu His Ser Ile Asn Tyr Pro Phe Leu Ile Ile Gly Lys Gly Ser
50 55 60

Asn Cys Leu Phe Asp Asp Arg Gly Phe Asp Gly Phe Val Leu Tyr Asn
65 70 75 80

Ala Ile Tyr Gly Lys Gln Phe Leu Glu Asp Ala Arg Ile Lys Ala Tyr
85 90 95

Ser Gly Leu Ser Phe Ala Ala Leu Gly Lys Ala Thr Ala Tyr Asn Gly
100 105 110

Tyr Ser Gly Leu Glu Phe Ala Ala Gly Ile Pro Gly Ser Val Gly Gly
115 120 125

Ala Ile Phe Met Asn Ala Gly Thr Asn Glu Ser Asp Ile Ser Ser Val
130 135 140

Val Arg Asn Val Glu Thr Ile Asn Ser Glu Gly Glu Leu Cys Ser Tyr
145 150 155 160

Ser Val Glu Glu Leu Glu Leu Ser Tyr Arg Ser Ser Arg Phe His Arg
165 170 175

Gln Gln Glu Phe Ile Leu Ser Ala Thr Phe Gln Leu Ser Lys Lys Gln
180 185 190

Val Ser Ala Asp His Ser Lys Ser Ile Leu Gln His Arg Leu Met Thr
195 200 205

Gln Pro Tyr Thr Gln Pro Ser Ala Gly Cys Ile Phe Arg Asn Pro Glu
210 215 220

Gly Thr Ser Ala Gly Lys Leu Ile Asp Ala Ala Gly Leu Lys Gly Leu
225 230 235 240

Ala Ile Gly Gly Ala Gln Ile Ser Pro Leu His Ala Asn Phe Ile Ile
245 250 255

Asn Thr Gly Lys Ala Thr Ser Asp Glu Val Lys Gln Leu Ile Ala Ile
260 265 270

Ile Gln Ser Thr Leu Lys Thr Gln Gly Ile Asp Leu Glu His Glu Ile
275 280 285

Arg Ile Ile Pro Tyr Gln Pro Lys Ile His Ser Pro Val Ser Glu Lys

290 295 300

<210> 8
<211> 310
<212> PRT
<213> Rickettsia prowazekii

<400> 8
Met Ile Gln Asn Pro Met Ile Lys Leu Cys Asn Glu Ser Asn Asn Met
1 5 10 15

Ser Ile Leu Pro Ile Ile Lys Gly Glu Tyr Lys Lys Asp Tyr Asn Leu
20 25 30

Lys His Leu Thr Trp Phe Lys Val Gly Gly Asn Ala Glu Ile Phe Phe
35 40 45

Lys Pro Phe Asp Phe Ala Asp Leu Lys Ser Phe Leu Ile Gln Asn Lys
50 55 60

Gln Lys Leu Pro Ile Thr Thr Phe Gly Ser Gly Ser Asn Ile Ile Ile
65 70 75 80

Arg Asp Gly Gly Ile Glu Gly Val Val Ile Lys Leu Gly Gln Asn Phe
85 90 95

Asn Lys Ile Glu Phe Leu Asp Asn His Leu Ile Val Gly Ser Ser Cys
100 105 110

Leu Asn Tyr Asn Leu Ala Arg Phe Cys Gln Ala Asn Ala Ile Ser Gly
115 120 125

Phe Glu Phe Leu Val Gly Ile Pro Gly Thr Ile Gly Gly Gly Val Ile
130 135 140

Met Asn Ala Gly Ala Tyr Gly Ser Ala Phe Gln Asp Ile Ile Val Gln
145 150 155 160

Val Glu Ala Leu Asp Phe Ser Gly Asn Phe Leu Thr Phe Thr Asn Lys
165 170 175

Glu Ile Gly Phe Lys Tyr Arg Gly Asn Asn Leu Pro Lys Asp Leu Ile
180 185 190

```
Leu Leu Lys Ala Val Phe Lys Val Asn Lys Gly Asp Ser Gln Asn Ile
        195                 200                 205

Leu Leu Lys Met Asn Lys Ile Asn Asn Thr Arg Ser Ser Thr Gln Pro
    210                 215                 220

Ile Lys Glu Arg Thr Gly Gly Ser Thr Phe Ile Asn Pro Glu Gly Arg
225                 230                 235                 240

Lys Ser Trp Glu Leu Ile Asp Lys Ala Gly Leu Arg Gly Tyr Arg Ile
                245                 250                 255

Gly Gly Ala Ser Ile Ser Glu Leu His Cys Asn Phe Met Ile Asn Asn
            260                 265                 270

Gly Asn Ala Thr Ala Lys Asp Leu Glu Asp Leu Gly Asn Phe Val Arg
        275                 280                 285

Gln Lys Val Phe Glu Asp Ser Gly Val Glu Leu Asn Trp Glu Ile Lys
    290                 295                 300

Arg Ile Gly Lys Tyr Val
305                 310
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<210> 9
<211> 341
<212> PRT
<213> Haemophilus influenzae

<400> 9

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Met Gln Asn Leu Gln Pro Phe His Thr Phe His Ile Gln Ser Asn Ala
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Arg Glu Ile Ile Glu Ala His Ser Ile Glu Gln Leu Gln Gln Val Trp
            20                  25                  30

Ala Asn Ser Lys Ser Glu Asn Leu Pro Thr Leu Phe Leu Gly Gln Gly
        35                  40                  45

Ser Asn Val Leu Phe Leu Asp Asp Phe Asn Gly Ile Val Ile Leu Asn
    50                  55                  60

Arg Leu Met Gly Ile Thr His Glu Gln Asp Ala Asn Phe His Tyr Leu
65                  70                  75                  80

His Val Asn Gly Gly Glu Asn Trp His Lys Leu Val Glu Trp Ser Ile
                85                  90                  95
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Asn Asn Gly Ile Tyr Gly Leu Glu Asn Leu Ala Leu Ile Pro Gly Cys
100 105 110

Ala Gly Ser Ala Pro Ile Gln Asn Ile Gly Ala Tyr Gly Val Glu Phe
115 120 125

Lys Asp Val Cys Asp Tyr Val Glu Val Leu Asn Leu Asn Thr Asn Glu
130 135 140

Thr Phe Arg Leu Asp Thr Glu Gln Cys Glu Phe Gly Tyr Arg Glu Ser
145 150 155 160

Ile Phe Lys His Arg Tyr Gln Gln Gly Tyr Val Ile Thr Ala Val Gly
165 170 175

Leu Lys Leu Lys Lys Asp Trp Gln Pro Ile Leu Lys Tyr Gly Ser Leu
180 185 190

Val Glu Phe Asp Pro Lys Thr Val Thr Ala Lys Gln Ile Phe Asp Glu
195 200 205

Val Cys His Ile Arg Gln Ser Lys Leu Pro Asp Pro Asn Glu Val Gly
210 215 220

Asn Ala Gly Ser Phe Phe Lys Asn Pro Val Val Ser Ser Glu His Phe
225 230 235 240

Glu Glu Ile Lys Lys His His Glu Asn Leu Pro His Phe Pro Gln Ala
245 250 255

Asp Gly Ser Val Lys Leu Ala Ala Gly Trp Leu Ile Asp Gln Cys Asn
260 265 270

Leu Lys Gly Phe Gln Ile Gly Gly Ala Ala Val His Lys Lys Gln Ala
275 280 285

Leu Val Leu Ile Asn Lys Asn Gly Ala Thr Gly Gln Asp Val Val Lys
290 295 300

Leu Ala His His Val Arg Gln Thr Val Ala Glu Lys Phe Gly Val Tyr
305 310 315 320

Leu Gln Pro Glu Val Arg Phe Ile Ser Ala Thr Gly Glu Val Asn Ser
325 330 335

Glu Gln Ile Ile Thr
340

<210> 10
<211> 342
<212> PRT
<213> Salmonella typhimurium

<400> 10

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Met Thr His Ser Leu Lys Pro Trp Asn Thr Phe Gly Ile Asp His Cys
  1               5                  10                  15

Ala Lys His Ile Val Cys Ala Glu Asn Glu Gln Gln Leu Leu Ser Ala
             20                  25                  30

Trp Gln Gln Ala Thr Arg Glu Gly Leu Pro Val Met Ile Leu Gly Glu
         35                  40                  45

Gly Ser Asn Val Leu Phe Leu Glu Asn Tyr Ala Gly Thr Val Ile Leu
     50                  55                  60

Asn Arg Leu Lys Gly Ile Glu Val Asn Glu Thr Ala Asp Ala Trp His
 65                  70                  75                  80

Leu His Val Gly Ala Gly Glu Asn Trp His Gln Leu Val Arg Tyr Ala
                 85                  90                  95

Leu Asp Asn Asn Met Pro Gly Leu Glu Asn Leu Ala Leu Ile Pro Gly
            100                 105                 110

Cys Val Gly Ser Ser Pro Ile Gln Asn Ile Gly Ala Tyr Gly Val Glu
        115                 120                 125

Leu Gln Arg Val Cys Asp Tyr Val Asp Cys Val Glu Leu Glu Thr Gly
    130                 135                 140

Lys Arg Leu Arg Leu Ser Ala Ala Glu Cys Arg Phe Gly Tyr Arg Asp
145                 150                 155                 160

Ser Ile Phe Lys Asn Glu Tyr Gln Asp Arg Val Ala Ile Val Ala Val
                165                 170                 175

Gly Leu Arg Leu Ser Lys Gln Trp Gln Pro Val Leu Thr Tyr Gly Asp
            180                 185                 190

Leu Thr Cys Leu Asp Pro Lys Thr Val Thr Ala Gln Gln Val Phe Asp
        195                 200                 205

Ala Val Cys His Met Arg Thr Thr Lys Leu Pro Asp Pro Lys Val Asn
```

210 215 220

Gly Asn Ala Gly Ser Phe Phe Lys Asn Pro Val Val Ala Ala Asp Ile
225 230 235 240

Ala Met Glu Leu Leu Glu Arg Phe Pro Asn Ala Pro His Tyr Pro Gln
245 250 255

Ala Asp Gly Ser Val Lys Leu Ala Ala Gly Trp Leu Ile Asp Gln Cys
260 265 270

Gln Leu Lys Gly Val Thr Ile Gly Gly Ala Ala Val His Arg Gln Gln
275 280 285

Ala Leu Val Leu Ile Asn Ala Asn Asp Ala Thr Ser Lys Asp Val Val
290 295 300

Ala Leu Ala His His Val Arg Gln Lys Val Gly Glu Lys Phe Asn Val
305 310 315 320

Trp Leu Glu Pro Glu Val Arg Phe Ile Gly Arg Ser Gly Glu Val Asn
325 330 335

Ala Val Glu Ser Ile Ala
340

<210> 11
<211> 351
<212> PRT
<213> Bordetella pertussis

<400> 11
Met Ser Thr Val Pro Ala Arg Ile Glu Pro Val Ala Pro Leu Ala Pro
1 5 10 15

Gln Ala Gln Asp Leu Arg Cys Phe Asn Thr Leu Gly Leu Ala Ser His
20 25 30

Ala Pro Ala Phe Val Ala Leu Thr Glu Pro Ser Gln Leu Pro Ala Leu
35 40 45

Ser Ala Leu Ala Pro Arg Phe Arg Gln Leu Val Val Leu Gly Gly Gly
50 55 60

Ser Asn Val Val Leu Pro Ala Ser Ile Asp Gly Leu Val Ala Gln Val
65 70 75 80

```
Arg Leu Pro Gly Val Arg Leu Val Gly Gln Cys Ala Asp Ala Trp Val
                85                  90                  95

Val Glu Ala Ala Ala Gly Glu Asn Trp His Gly Phe Val Thr Ala Cys
            100                 105                 110

Val Asp Asn Gly Trp Asp Gly Leu Glu Asn Leu Ala Leu Ile Pro Gly
        115                 120                 125

Thr Val Gly Ala Ala Pro Val Gln Asn Ile Gly Ala Tyr Gly Val Glu
    130                 135                 140

Leu Ala Asp Arg Phe His Ser Leu Thr Ala Trp Asp Val Lys Gly Gly
145                 150                 155                 160

Arg Trp Val Glu Met Gly Ala Ala Glu Cys Arg Phe Ala Tyr Arg Asp
                165                 170                 175

Ser Phe Phe Lys His Gln Glu Pro Gly Ala Trp Val Ile Gly Ser Val
            180                 185                 190

Arg Phe Ala Leu Pro Arg Pro Trp Gln Pro Val Leu Asp Tyr Pro Asp
        195                 200                 205

Leu Gln Arg His Ala Ala Leu Asp Gly Ala Ala Pro Thr Ala Arg Ala
    210                 215                 220

Val Tyr Asp Ala Val Cys Ala Ile Arg Arg Ala Lys Leu Pro Asp Pro
225                 230                 235                 240

Ala Val Val Gly Asn Ala Gly Ser Phe Phe Lys Asn Pro Leu Val Asp
                245                 250                 255

Ala Gly Thr Arg Gln Ala Leu Leu Gly Arg Phe Pro Gly Leu Val Ser
            260                 265                 270

Tyr Pro Gln Pro Asp Gly Arg Tyr Lys Leu Ala Ala Gly Trp Leu Ile
        275                 280                 285

Asp Gln Cys Gly Trp Lys Gly Arg Gln Leu Gly Ala Ala Gly Val His
    290                 295                 300

Asp Arg Gln Ala Leu Val Leu Val Asn Arg Gly Gly Ala Gln Ala Arg
305                 310                 315                 320

Asp Ile Met Ala Leu Ala Ala Ala Ile Gln Gly Asp Val Glu Arg Arg
                325                 330                 335
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Tyr Gly Val Arg Leu Glu Pro Glu Pro Val Val Val Pro Ala Arg
340 345 350

Patent Application Publication